

WHAT IS CLAIMED IS:

1                   1.       An internal combustion engine with a plurality of cylinders,  
2       the engine including an intake manifold and an exhaust manifold, the engine further  
3       comprising:  
4                   a first exhaust path for receiving and routing exhaust gases;  
5                   a first NO<sub>x</sub> adsorber located in the first exhaust path;  
6                   a second exhaust path for receiving and routing exhaust gases;  
7                   a flow control valve between the exhaust manifold and the first and  
8       second exhaust paths for controlling the relative amounts of exhaust gas flowing  
9       through the first and second exhaust paths; and  
10                  a first injector for injecting a reductant into the exhaust gas stream,  
11       the first injector being located so as to inject the reductant at a location adjacent to  
12       the flow control valve to cause mixing of the reductant and the exhaust gas and to  
13       allow regeneration of the first NO<sub>x</sub> adsorber.

1                   2.       The internal combustion engine of claim 1 wherein the first  
2       injector is located so as to inject the reductant at a location immediately downstream  
3       of the flow control valve along the first exhaust path.

1                   3.       The internal combustion engine of claim 1 further comprising:  
2                   a second NO<sub>x</sub> adsorber located in the second exhaust path; and  
3                   a second injector for injecting a reductant into the exhaust gas stream,  
4       the second injector being located so as to inject the reductant at a location adjacent  
5       to the flow control valve to cause mixing of the reductant and the exhaust gas and  
6       to allow regeneration of the second NO<sub>x</sub> adsorber.

1                   4.       The internal combustion engine of claim 3 wherein the second  
2       injector is located so as to inject the reductant at a location immediately downstream  
3       of the flow control valve along the second exhaust path.

1                   5.       The internal combustion engine of claim 4 wherein the first  
2 injector is located so as to inject the reductant at a location immediately downstream  
3 of the flow control valve along the first exhaust path.

1                   6.       An internal combustion engine with a plurality of cylinders,  
2 the engine including an intake manifold and an exhaust manifold, the engine further  
3 comprising:  
4                   a first exhaust path for receiving and routing exhaust gases;  
5                   a first NO<sub>x</sub> adsorber located in the first exhaust path;  
6                   a second exhaust path for receiving and routing exhaust gases;  
7                   a first flow control valve between the exhaust manifold and the first  
8 exhaust path and a second flow control valve between the exhaust manifold and the  
9 second exhaust path, the first and second flow control valves controlling the relative  
10 amounts of exhaust gas flowing through the first and second exhaust paths; and  
11                   a first injector for injecting a reductant into the exhaust gas stream,  
12 the first injector being located so as to inject the reductant at a location adjacent to  
13 the first flow control valve to cause mixing of the reductant and the exhaust gas and  
14 to allow regeneration of the first NO<sub>x</sub> adsorber.

1                   7.       The internal combustion engine of claim 6 further comprising:  
2                   a second NO<sub>x</sub> adsorber located in the second exhaust path; and  
3                   a second injector for injecting a reductant into the exhaust gas stream,  
4 the second injector being located so as to inject the reductant at a location adjacent  
5 to the second flow control valve to cause mixing of the reductant and the exhaust gas  
6 and to allow regeneration of the second NO<sub>x</sub> adsorber.

1                   8.       The internal combustion engine of claim 7 wherein the second  
2 injector is located so as to inject the reductant at a location immediately upstream  
3 of the second flow control valve along the second exhaust path.

1                   9.       The internal combustion engine of claim 6 wherein the first  
2 injector is located so as to inject the reductant at a location immediately upstream  
3 of the first flow control valve along the first exhaust path.

1                   10.     In an internal combustion engine with a plurality of cylinders,  
2     the engine including an intake manifold and an exhaust manifold, the engine further  
3     including, a first exhaust path for receiving and routing exhaust gases, a first NO<sub>x</sub>  
4     adsorber located in the first exhaust path, a second exhaust path for receiving and  
5     routing exhaust gases, at least one flow control valve between the exhaust manifold  
6     and the first and second exhaust paths for controlling the relative amounts of exhaust  
7     gas flowing through the first and second exhaust paths, and a first injector for  
8     injecting a reductant into the exhaust gas stream, the first injector being located so  
9     as to inject the reductant at a location adjacent to a flow control valve to cause  
10    mixing of the reductant and the exhaust gas and to allow regeneration of the first  
11    NO<sub>x</sub> adsorber, the method comprising:

12                   operating the engine in an active mode wherein exhaust gas flows  
13    through the first exhaust path and through the first NO<sub>x</sub> adsorber such that the first  
14    NO<sub>x</sub> adsorber adsorbs NO<sub>x</sub> from the exhaust gas; and

15                   subsequently, operating the engine in a regenerative mode wherein  
16    a reduced amount of the exhaust gas flows through the first exhaust path and  
17    through the first NO<sub>x</sub> adsorber and wherein the reductant is injected into the reduced  
18    amount of the exhaust gas at a location adjacent to a flow control valve to cause  
19    mixing of the reductant and the exhaust gas such that the first NO<sub>x</sub> adsorber  
20    catalytically reduces the previously adsorbed NO<sub>x</sub> to regenerate the first NO<sub>x</sub>  
21    adsorber.

1                   11.     In an internal combustion engine with a plurality of cylinders,  
2     the engine including an intake manifold and an exhaust manifold, the engine further  
3     including, a first exhaust path for receiving and routing exhaust gases, a first NO<sub>x</sub>  
4     adsorber located in the first exhaust path, a second exhaust path for receiving and  
5     routing exhaust gases, a second NO<sub>x</sub> adsorber located in the second exhaust path,  
6     at least one flow control valve between the exhaust manifold and the first and second  
7     exhaust paths for controlling the relative amounts of exhaust gas flowing through the  
8     first and second exhaust paths, a first injector for injecting a reductant into the  
9     exhaust gas stream, and a second injector for injecting a reductant into the exhaust  
10    gas stream, the first injector being located so as to inject the reductant at a location

11 adjacent to a flow control valve to cause mixing of the reductant and the exhaust gas  
12 and to allow regeneration of the first NO<sub>x</sub> adsorber, the second injector being  
13 located so as to inject the reductant at a location adjacent to a flow control valve to  
14 cause mixing of the reductant and the exhaust gas and to allow regeneration of the  
15 second NO<sub>x</sub> adsorber, the method comprising:

16 operating the engine in an active mode wherein exhaust gas flows  
17 through the first exhaust path and through the first NO<sub>x</sub> adsorber such that the first  
18 NO<sub>x</sub> adsorber adsorbs NO<sub>x</sub> from the exhaust gas and exhaust gas flows through the  
19 second exhaust path and through the second NO<sub>x</sub> adsorber such that the second NO<sub>x</sub>  
20 adsorber adsorbs NO<sub>x</sub> from the exhaust gas;

21 subsequently, operating the engine in a first regenerative mode  
22 wherein a reduced amount of the exhaust gas flows through the first exhaust path  
23 and through the first NO<sub>x</sub> adsorber and wherein the reductant is injected into the  
24 reduced amount of the exhaust gas at a location adjacent to a flow control valve to  
25 cause mixing of the reductant and the exhaust gas such that the first NO<sub>x</sub> adsorber  
26 catalytically reduces the previously adsorbed NO<sub>x</sub> to regenerate the first NO<sub>x</sub>  
27 adsorber; and

28 subsequently, operating the engine in a second regenerative mode  
29 wherein a reduced amount of the exhaust gas flows through the second exhaust path  
30 and through the second NO<sub>x</sub> adsorber and wherein the reductant is injected into the  
31 reduced amount of the exhaust gas at a location adjacent to a flow control valve to  
32 cause mixing of the reductant and the exhaust gas such that the second NO<sub>x</sub> adsorber  
33 catalytically reduces the previously adsorbed NO<sub>x</sub> to regenerate the second NO<sub>x</sub>  
34 adsorber.

1 12. The method of claim 11 further comprising:

2 when the engine is operated in the first regenerative mode and the  
3 reduced amount of the exhaust gas flows through the first exhaust path to regenerate  
4 the first adsorber, routing a remainder of the exhaust gas through the second exhaust  
5 path such that the second adsorber remains active.

- 1                   13.    The method of claim 11 further comprising:
- 2                    when the engine is operated in the second regenerative mode and the
- 3 reduced amount of the exhaust gas flows through the second exhaust path to
- 4 regenerate the second adsorber, routing a remainder of the exhaust gas through the
- 5 first exhaust path such that the first adsorber remains active.